

3-phase Oil + Gas + Water fluid model

Multi-phase fluid model based on three pseudo-components $C = \{W, O, G\}$:

W	water pseudo-component, which may include minerals (assuming formation water and injection water composition is the same)
O	dead oil pseudo-component
G	dry gas pseudo-component

existing in three possible phases $\alpha = \{w, o, g\}$:

w	water phase, consisting of water component, dead oil pseudo-component and dry gas pseudo-component
o	oil phase, consisting of dead oil pseudo-component and dissolved dry gas pseudo-component (called Solution Gas) and water
g	gas phase, consisting of dry gas pseudo-component and vaporized dead oil pseudo-component (called Volatile Oil)

The volumetric phase-balance equations is:

$$(1) \quad s_w + s_o + s_g = 1$$

where

$s_w = \frac{V_w}{V}$	share of total fluid volume V occupied by water phase V_w
$s_o = \frac{V_o}{V}$	share of total fluid volume V occupied by oil phase V_o
$s_g = \frac{V_g}{V}$	share of total fluid volume V occupied by gas phase V_g

The accountable cross-phase exchanges are illustrated in the table below:

	w	o	g
W	x	x	x
O	x	x	x
G	x	x	x

Injection water and production water are assumed to have the same dynamic fluid properties and not being discerned.

It's a typical case for saturated reservoir.

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